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PROGRAM

BC hydro

BRITISH COLUMBIA

Rainbow Rocks Stone's Sheep Health Evaluation: Working Plan

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The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

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INTRODUCTION

A small herd (~20) of Stone's sheep (*Ovis dalli stonei*) winters on 20 Mile Point, a low elevation set of cliffs adjacent to the Peace Arm of the Williston Reservoir in north-central British Columbia. These sheep are reported to experience severe hair loss in winter, and are believed to be infested with, and severely affected by, winter ticks (*Dermacentor albipictus*) (J. Elliott, BC Environment, personal communication). The problem is believed to be debilitating to the sheep and the herd is suspected to be in decline. It is suggested that these sheep are in more frequent contact with moose (*Alces alces*) which are forced to winter at higher than normal elevations due to the flooding of the lower valley bottom by the Williston Reservoir (J. Elliott, BC Environment, personal communication).

The project objectives are:

- To confirm the presence of winter ticks on Stone's sheep wintering at low elevation on 20 Mile Point
- To determine the extent to which ticks affect the overall health and productivity of the herd
- To determine the cause of the winter tick problem
- To investigate potential solutions to interrupt the tick cycle, (IF it's found to be affecting the health of the herd)

BACKGROUND

Population Size and Distribution of Stone's Sheep North of the Peace Arm

There are an estimated 11,000 Stone's sheep in British Columbia, 10% of which reside in the Williston Reservoir watershed (Davidson and Dawson 1990). Stone's sheep occur almost exclusively north of the 56th parallel in BC (corresponding to the Peace Arm of the Williston Reservoir). A few small herds exist south of the Peace Arm, with the Pine River presently marking the approximate southern extent of their distribution (Wood and Hengeveld 1998). Prior to the creation of the Williston Reservoir, Stone's sheep were reported to travel back and forth across the Peace River on an annual basis (Elliott 1985).

Previous inventory data for Stone's sheep directly north of the Peace Arm is sparse as only two stratified random block surveys have been conducted to date. Twenty-six sheep were sighted between Schooler Creek and Butler Ridge in March 1989, resulting in a population

estimate of 99 sheep (Hirst 1990). Davidson (1991) observed 74 sheep in the same area in March 1990, and estimated the population at 74-101 animals. The number of sheep sighted specifically on 20 Mile Point were only reported by Davidson (1991): 31 sheep on the pre-stratification flight, and 21 during the subsequent aerial survey. However, incidental sightings and reports suggest that sheep numbers are declining in this area (J. Elliott, BC Environment, pers. comm.). The apparent decline may be attributed to one or a combination of the following factors: reduced health of the herd due to infestation of winter ticks and/or other disease agents, increased winter predation by coyotes and wolves aided by the access corridor created by the frozen reservoir, reduced winter range capacity resulting from flooding of the lower portion of 20 Mile Point, removal of sheep from 20 Mile for transplant purposes (see below), hunting pressure (a sheep hunting restriction between Dunlevy Cr, Schooler Cr, and the Graham River including 20 Mile Point was lifted in 1984; currently a 2.5 month open season exists for full curl rams), and/or poaching pressure.

In 1990, the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP) undertook the first of three successive transplants of Stone's sheep from the north side of the Peace Arm south to the Mt. Frank Roy/Mt. Monteith area (Wood and Hengeveld 1998). No previous history of disease or parasitic infection had been recorded for the source populations (including 20 Mile Point) (BC Environment 1989). Between 1990 and 1993, 17 Stone's sheep were removed from 20 Mile Point for transplant purposes (Wood 1995; Backmeyer 2000) which may have contributed to the apparent decline of sheep in this area.

Ecology of Stone's Sheep North of the Peace Arm

During the transplant activities of 1990 and 1991, 4 additional sheep from the source areas were radio-collared and monitored for comparison with the transplanted animals. Three sheep were collared in 1990 (1 ram on Nabesche Ridge; 2 ewes on Butler Ridge) and a ewe on 20 Mile Point was collared in 1991 (Backmeyer 2000). Monthly fixed-wing monitoring of the collared animals ceased in May 1994.

Three different wintering strategies emerged from the 4 collared sheep: 2 sheep used windswept alpine, 1 used mid-elevation timbered bluffs, and 1 used low elevation shrub/grassland adjacent to escape terrain (20 Mile Point ewe) (Backmeyer 2000). Spring movements from winter to summer ranges occurred between mid-May and early June; annual home ranges varied from 43-132 km^2 (Backmeyer 2000). All collared sheep used

alpine or high elevation rock habitat during summer, including the 20 Mile Point ewe that moved at least 15 km north to summer at high elevation on Aylard Ridge. The collared sheep returned to winter ranges in mid to late November - the earliest documented move to lower elevations was late October.

Ecology of Winter Ticks

Hard ticks (*Dermacentor spp.*) are external parasites that feed on blood, spending all or a portion of their life cycle on the skin of their hosts (Schwantje 1988a). The "winter" or "moose" tick (*D. albipictus*) occurs as far north as 62° (Samuel 1989), while the "wood" tick (*D. andersonii*) has been documented only as far as 53° north in BC and 54° north in Alberta (Wilkinson 1967).

A one-host tick, *D. albipictus* completes its life cycle by attaching to only one animal (Lankester and Samuel 1998). Tick larvae become active with autumn frosts in late August to early September, and start climbing vegetation to wait for a passing large mammal. The peak aggregations of tick larvae on vegetation occur in late September to early October, coinciding with the peak breeding season for moose. Moose are more active during the rut, probably resulting in more encounters with larvae on vegetation (Lankester and Samuel 1998). Autumn weather is critical to the ticks' survival (Samuel and Welch 1991). Larvae that do not attach to a host usually die after the first cold weather or deep snows, usually by mid-November. Once on the host, *D. albipictus* ingests 3 meals of blood as it molts from larvae to nymph to adult between November and April. Blood-fed adult females drop from hosts from late March through April in order to lay eggs (Drew and Samuel 1989). Female ticks lay 3,000 to 8,000 eggs on ground vegetation (the peak of egg laying is early June), which hatch to larvae in early August.

Winter ticks have been associated with significant losses in moose populations in northern Canada. Where the distribution of moose and ticks overlaps, moose are the most severely infested and affected host (Lankester and Samuel 1998). Heavy infestations cause excessive grooming by moose, which results in a characteristic pattern of damage and/or loss of the winter hair coat (Lankester and Samuel 1998). In severely affected moose, mortality is usually associated with poor body condition and inclement weather. Among other northern ungulates, *D. albipictus* is commonly found on mule deer (*O. hemionus*), white-tailed deer (*O. virginianus*), and elk, and to a lesser degree on bison (*Bison bison*), sheep (*Ovis sp.*),

mountain goats (*Oreamnos americanus*), and caribou (*Rangifer tarandus*), however, reports of alopecia and mortality to the same degree as moose are rare. Average numbers of ticks on moose can range from 30,000 - 40,000 in some areas, while substantially lower averages have been reported for elk (1,200) and white-tailed deer (550) (Samuel et al. 2000). Reports of numbers of ticks on wild sheep are rare. There are no published studies reporting winter ticks on Stone's sheep, or on the extent and effects of winter tick infestation in bighorn sheep (*O. canadensis*). Three of 18 Rocky Mountain bighorns (*O. c. canadensis*) examined in southeastern BC had a few *D. albipictus* (Schwantje 1988b). Ticks are generally not believed to cause major health problems for wild sheep (Schwantje 1988a; W. M. Samuel, University of Alberta, personal communication).

Associations Between Stone's Sheep, Other Ungulates, and Winter Ticks in the 20 Mile Point Area

It was initially suggested that the 20 Mile Point sheep may be contracting winter ticks from moose displaced from the Peace River valley bottom by the creation of the Williston Reservoir. However, moose exist at low to moderate densities along the north side of the Peace Arm in contrast to the moderate to high densities of Rocky Mountain elk (B. Culling, Diversified Environmental Services, Ft. St. John; R. Woods, BC Environment, Ft. St. John). The abundance of elk results from the successful transplant of 135 elk into the Dunlevy area in the mid-80's to supplement the small existing herd; the population has grown substantially and numbers are currently estimated at 500-600 animals (Wood and Hengeveld 2001). A number of prescribed burns conducted throughout the 80's and 90's along the north shore of the Peace Arm have created favourable grassland conditions for the elk which have moved westwards to colonize the entire north shore at least as far as the Nabesche drainage. Although elk are reported to carry substantially fewer ticks per individual than moose (Lankester and Samuel 1998), the higher numbers of elk and the use of similar grassland habitats to sheep, likely places them into more contact with the 20 Mile Point sheep. The ranges and habitats used by sheep, elk, and moose in the spring (when female ticks drop off their host to lay eggs) and fall (when tick larvae find host to attach themselves to) is of critical importance in determining the cause and extent of the tick problem in 20 Mile Point sheep. If the sheep are indeed affected by winter ticks, it is possible that the tick cycle could be independent of the larger ungulates now, with the sheep dropping off ticks and subsequently picking up larvae on areas of steeper terrain used exclusively by sheep.

STUDY AREA

The study area is on the north side of the Peace Arm, extending from the Nabesche River east to Butler Ridge and north to the Graham River (Figure 1). The area lies within the Peace Foothills ecosection of the Central Canadian Rocky Mountains ecoregion. Elevations range from 670 m adjacent to the Williston Reservoir to mountain peaks at 2170 m. Biogeoclimatic zones include the Peace moist warm Boreal White and Black Spruce (BWBSmw1) between 670 - 900 m, the Murray wet cool BWBSwk1 between 900 - 1050 m, the Bullmoose moist very cold Engelmann Spruce Subalpine Fir (ESSFmv2) between 1050 - 1500 m, and Alpine Tundra (ATn) above 1500m (DeLong et al. 1990, DeLong et al. 1994) 20 Mile Point itself is situated between Adams and Aylard Creeks within the BWBSmw1, and is comprised of two sets of cliffs with a bench of immature aspen inbetween. The cliffs extend approximately 200 m above the reservoir water level.

Snow accumulations in the Rocky Mountain foothills are relatively low due to the rainshadow effect and the common Chinook wind events that result in windswept terrain. The sandstones and shales of the Rocky Mountain foothills (Delong et al. 1994), in combination with the relatively low snow depths, provide good Stone's sheep habitat.

Other common ungulates in the study area include Rocky Mountain elk (*Cervus elaphus*), moose, mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*); woodland caribou (*Rangifer tarandus*) and mountain goats (*Oreamnos americanus)* exist at higher elevations. The primary predators of Stone's sheep are suspected to be coyotes (*Canis latrans*), wolves (*Canis lupus*), and golden eagles (*Aquila chrysaeto)*, although wolverine (*Gulo gulo*), grizzly bear (*Ursus arctos*), black bear (*Ursus americana*),and lynx (*Lynx canadensis*) and are also potential predators.

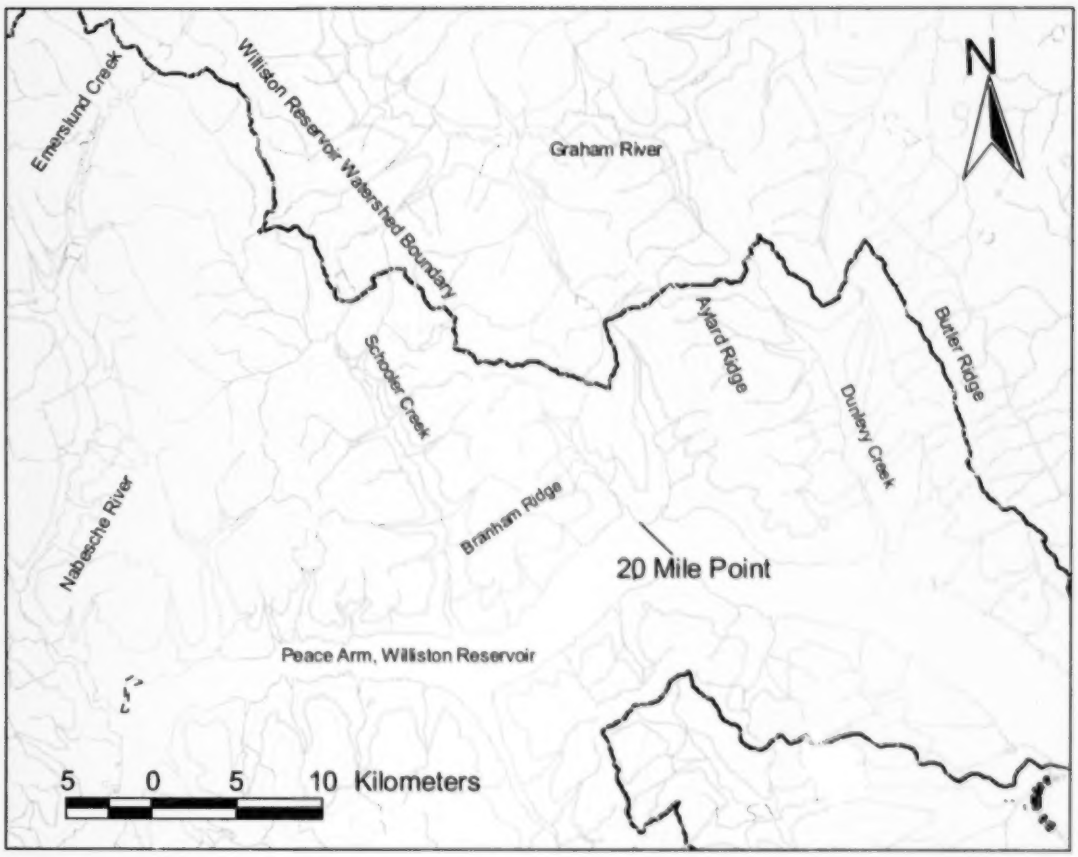

Figure 1. Location of study area on the north side of the Peace Arm of Williston Reservoir, north-central B.C.

METHODS

1. A full health examination of sheep wintering on 20 Mile Point will be conducted. If the 20 Mile Point sheep are found to possess high tick loads, sheep wintering on alpine ranges in the upper Nabesche and Schooler River drainages will also be examined for comparative purposes.

2. Seasonal distribution, movement patterns, and habitat use of radio-collared 20 Mile Point sheep will be determined. Particular emphasis will be paid to the habitats and elevations used during the peak tick period in fall.

A drive-net and Bell 206 helicopter will be used to capture a minimum of 5 sheep residing on 20 Mile Point. An additional 5 sheep using alpine terrain in the upper Nabesche and Schooler drainages may be captured by net-gunning from a Bell 206. All sheep will be examined a wildlife veterinarian, and biological samples will be obtained for further analysis. Samples will be provided to a variety of labs for analyses. Sheep will be administered Vitamin E/selenium, ivermectin, and tetracycline (long-acting antibiotic) prior to release.

The following sheep health screening and sampling protocol will be followed (H. Schwantje, BC Environment, personal communication):

- Physical Exam (age, sex, estimated weight, general health, external parasites e.g. ticks, mites)
- Pharyngeal Swabs (for Pasteurella spp., biotyping)
- Blood Samples
  - serum (Brucella ovis, BRSV, blood chemistry, serum progesterone for pregnancy, trace minerals)
  - whole blood (genetic analysis, immunological studies, CBC)
- Hair Samples (genetic analysis)
- Fecal Samples (lungworm larvae, other GI parasites, fecal nitrogen)

Five adult ewes examined from 20 Mile Point will be fitted with Lotek LMRT-3 radio-collars for future monitoring; all other sheep will be ear-tagged. Sheep captured in alpine habitat will also be collared for subsequent monitoring. Collars will help reduce sightability bias during population surveys, and enable a more accurate population estimate to be obtained

using mark-resight estimation. Collared animals will be monitored monthly for a 3 year period primarily by fixed-wing aircraft. Two additional monitoring flights will be conducted during the peak tick season in fall. An aerial population inventory will be conducted in March using a Bell 206 helicopter.

CAPTURE AND MONITORING ACTIVITIES

CAPTURE	Mar 99	Mar 00	00/01	01/02	
Capture, examine, & collar new sheep	X	X			
Re-capture & examine collared sheep		X	X	X	
Capture, examine, & collar new alpine sheep		X			
Re-capture & examine collared alpine sheep			X	X	
Capture, examine, & collar elk and moose		X			
MONITORING[1]	**Spring**	**Lamb**	**Summ**	**Fall**	**Wint**
Weekly radio-telemetry, Stone's sheep only		X			
Weekly radio-telemetry, all ungulates				X	
Biweekly radio-telemetry, all ungulates	X				
Monthly radio-telemetry, all ungulates			X		X

[1] Spring (15 Apr – 15 May); Lambing (16 May – 30 June); Summer (1 July – 30 Sep); Fall (1 Oct -30 Nov); Winter (1 Dec – 15 Apr).

DELIVERABLES

Annual progress reports on capture, health status, and radio-telemetry monitoring will be prepared by 31 March of each year. Progress reports will include a summary of the movements and habitat use of each individual sheep on a seasonal basis. A final project report will be prepared upon completion of the project.

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